IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA,	)	
	)	
Plaintiff,	)	
	)	
v.	)	**Case No. 05-cv-329-GKF(PJC)**
	)	
TYSON FOODS, INC., et al.,	)	
	)	
Defendants.	)	

DECLARATION OF J. BERTON FISHER, Ph.D.

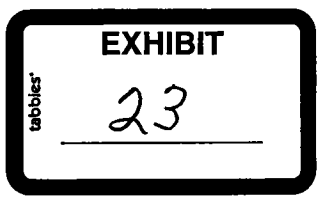
I, J. Berton Fisher, Ph.D., hereby declare as follows:

A. BACKGROUND

1.

I am a geochemist and geologist with expertise in the transport and fate of materials in the environment. I hold a Ph.D. and M.S. in Earth Sciences from Case Western Reserve University and a B.S. in Geology and Geophysics from Yale University. I am a Certified Professional Geologist, a Registered Professional Geoscientist in the State of Texas and a Registered Professional Geologist in the State of Mississippi. I have published scientific papers regarding technical environmental matters in peer-reviewed publications, and I have given numerous technical presentations regarding environmental matters at scientific meetings. I have worked on the engineering and scientific aspects of numerous environmental litigation, regulatory and transaction matters, including, specifically, environmental matters related to the land disposal of poultry wastes. I have worked professionally as a geochemist and geologist since 1973 and have worked on matters related to agricultural, industrial, petroleum and mining environmental contamination for nearly twenty-five years. My work experience includes consulting, industrial and academic positions. My experience in technical environmental matters includes site investigations, review of site investigation data, analysis of the chemical and physical characteristics of environmental samples, historic research on industrial and agricultural activities and processes, petroleum exploration and production, mining, the environmental chemistry of organic and inorganic contaminants and studies of the fate and transport of organic and inorganic contaminants in soils, sediments and water, including the collection of undisturbed cores of unconsolidated lake sediment and the geochronological analysis of undisturbed cores of unconsolidated lake sediments using natural and anthropogenic radioactive nuclides and paleontological markers.

2.



Since 1997 1 have worked on matters related to the environmental contamination by poultry wastes including the chemistry, generation and land disposal of poultry wastes, the identification of poultry waste constituents in the environment, their fate and transport in the environment, the effects of poultry waste contaminants on water quality, and the management of poultry waste land disposal in eastern Oklahoma and western Arkansas. I have served as a consultant to the Tulsa Metropolitan Utility Authority and the City of Tulsa with respect to poultry waste issues from 1997 to the present.

3.

I was retained by the Oklahoma Attorney General, beginning in 2004, to evaluate, provide analysis regarding and to advise on matters pertaining to poultry waste generation, poultry waste disposal practices and the fate and transport of land applied poultry waste.

B. EXPERT REPORT

4.

On May 15, 2008, I submitted an Expert Report to the Defendants in the above-captioned litigation (attached hereto as Ex. 1). This Expert Report contains statements, findings, analyses and opinions with respect to poultry waste generation, poultry waste disposal practices and the fate and transport of land applied poultry waste in the Illinois River Watershed ("IRW").

5.

In my Expert Report, I find that "[a]t present, nearly all…poultry waste is land disposed near where the waste is generated." (Expert Report, Ex. 1 at 4). This is a true and correct finding. I based this finding in large part on official records produced by the Oklahoma Department of Agriculture, Food and Forestry that identify locations where poultry waste has been land applied in relation to locations where that poultry waste was generated, deposition testimony of fact witnesses and experts and documents produced by the Defendants which show locations where poultry waste has been land applied in the IRW. *Id.* at f.n. 4.

6.

> "The terrain of the bulk of the Illinois River Watershed is mantled karst. …In mantled karst terrains the dissolution of carbonate units beneath a covering of soil and regolith creates expanded infiltration pathways including, sinkholes, solution expanded fractures, faults and caves. The fracturing and faulting within the Illinois River Watershed, combined with karstification (which enlarges subsurface faults and fractures) produces areas of high permeability, and results in a circumstance in which shallow ground water aquifers are particularly susceptible

to impact by surface contamination, including contamination by bacteria, that can readily travel from the soil surface to surface water and ground water during rainfall events.... Within such a karst terrain, there is little attenuation (reduction) of contaminants as they move from the land surface into and through the karst aquifer. Thus, land application of poultry waste to the karst terrain of the Illinois River Watershed means that constituents of this waste (including bacteria) travel readily through the soils and underlying geologic media to discharge at and into ground water springs and surface streams throughout the Illinois River Watershed. Further, because of the ready flow of water through a karst terrain of the type present in the Illinois River Watershed, there is strong interaction between surface water flow and ground water flow so that surface waters readily become ground water and ground water readily becomes surface water. The phenomenon is readily shown by the numerous springs and gaining and losing streams found within the Illinois River Watershed.

Soils within the Illinois River Watershed are formed mostly from the weathering of carbonate rocks, and are of low natural fertility....The soils are typically loams and are often rocky due to the presence of chert fragments. Loam soils are mixtures of sand, silt, clay and organic matter. Depending on the relative proportion of sand, silt and clay, these soils will be susceptible to infiltration or surface runoff....[S]oils more susceptible to run off dominate in the eastern and western portions of the Illinois River Watershed, while soils that are more susceptible to infiltration dominate in the central portion of the Illinois River watershed...Thus, contaminants deposited on the surface within the Illinois River Watershed are prone to runoff from soils in about half of the watershed and are prone to infiltration through soils in the remaining half of the watershed."

(Expert Report, Ex. 1 at 44-6).

I declare under penalty of perjury, under the laws of the United States of America, that the foregoing is true and correct.

Executed on the 5TH day of March, 2009.

J. Berton Fisher, Ph.D.

In the matter of

State of Oklahoma, ex rel., A. Drew Edmondson in his capacity as Attorney General of the State of Oklahoma, and Oklahoma Secretary of the Environment, C. MILES TOLBERT, in his capacity as the Trustee for Natural Resources for the State of Oklahoma, Plaintiffs

v.

Tyson Foods, Tyson Poultry, Tyson Chicken, Inc., Cobb-Vantress, Inc., Aviagen, Inc., Cal-Maine Foods, Cal-Mane Farms, Inc. Cargill, Inc., Cargill Turkey Products, LLC, George's, Inc., George's Farms, Inc., Peterson Farms, Inc., Simmons Foods, Inc. and Willowbrook Foods, Inc., Defendants.

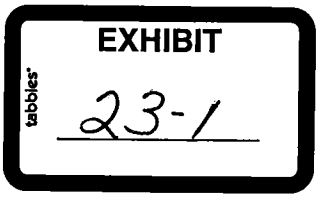
CASE NO. 05-CV-329- GFK-SAJ

in the United States District Court
for the Northern District of Oklahoma

Expert Report

of

J. Berton Fisher, Ph.D., CPG, RPG (TX #0201; MS#0301)
Lithochimeia, Inc.
110 West 7th Street, Suite 105
Tulsa, Oklahoma 74119
May 15, 2008



control the composition of feeds provided to their poultry.[2] These feeds contain high levels of phosphorous and metals. Historically, wastes produced by poultry owned by the Defendants have been land disposed by simple broadcast spreading near where such wastes are generated.[3] At present, nearly all of poultry waste is land disposed near where the waste is generated.[4] Once applied to the land, constituents of these wastes interact

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DOC20080107140816.pdf; DOC20080107140838.pdf; Georges.mdb; IRW Breeders -- Created by Court Order-Not Kept in Ordinary Course of Business.xls; IRW Broilers -- Created by Court Order - Not Kept in Ordinary Course of Business.xls; Peterson 2nd Supp Response to First Interr and RFP.pdf; SIMAG32198- number Birds and feed.pdf; Total Bird Counts.xls).

2 CM003472 - CM003581; CARTP007982 - CARTP010833; GE 34777 – GE 35008; GE 35127 – GE 35138; GE 36091 – GE 36458; PFIRWP-063697 - PFIRWP-064049; SIM AG 31786- SIM AG 32150; TSN0001NCFF – TSN0570NCFF; TSN0001SCFF – TSN0535SCFF.

3 Tyson Environmental Poultry Farm Management TSN0060CORP-TSN0118CORP; Deposition of Tommy Daniel, Ph. D. November 26, 2007, Page 26 line 23-25; Page 27 line 1-23; Page 50 line 17-25; Page 51 line 1-16; of Michael Langley, November 7, 2007, page 24 lines 6-19; page 26 lines 2-19; Deposition of Bart Snyder, November 8, 2007, page 19 line 1-11; page 19 line 17-line 25; page 20 line 1; Bell, D. D. and W. D. Weaver. 2002. Chicken, Meat and Egg Production, 5th Edition. Kluwer Academic Publishers, Norwell, Massachusetts, PI-Fisher00005909-PI-Fisher00007209); Wilson, W. O. 1974. Housing. Pp 218-247, in: Hanke, O. A.,, J. L. Siknner and J. H. Florea (eds.), American Poultry History 1823-1973. American Printing and Publishing, Madison, Wisconsin (PI-Fisher00008114 - PI-Fisher00008505).

4 PI-Fisher00027498-PI-Fisher00031831; Deposition of Tommy Daniel, Ph. D. November 26, 2007, Page 26 line 23-25; Page 27 line 1-23; Page 50 line 17-25; Page 51 line 1-16; Deposition of Michael Langley, November 7, 2007, page 24 lines 6-19; page 26 lines 2-19; Deposition of Bart Snyder, November 8, 2007, page 19 line 1-11; page 19 line 17-line 25; page 20 line 1.; TSN19381SOK-TSN19435SOK; TSN20629SOK-TSN20640SOK; TSN20598SOK-TSN20628SOK; TSN20569SOK-TSN20595SOK; TSN20561S0K-TSN20568S0K; TSN20538S0K- TSN20556S0K; TSN19835S0K-TSN19846S0K; TSN19241S0K-TSN19257S0K; TSN18746S0K-TSN18757S0K; TSN20517S0K-TSN20529S0K; TSN20504S0K-TSN20516S0K; TSN20470S0K-TSN20503S0K; TSN20480S0K-TSN20503S0K; TSN20455S0K-TSN20469S0K; TSN19685S0K-TSN19708S0K; TSN20417S0K-TSN20425S0K; TSN19098S0K-TSN19127S0K; TSN20403S0K-TSN20416S0K; TSN19847S0K-TSN19874S0K; TSN19875S0K-TSN19885S0K; TSN19278S0K-TSN19293S0K; TSN20381S0K-TSN20402S0K; TSN20372S0K-TSN20380S0K; TSN19294S0K-TSN19308S0K; TSN19294S0K-TSN19294S0K; TSN20300S0K-TSN20335S0K; TSN20426S0K-TSN20454S0K; TSN20431S0K-TSN20454S0K; TSN19804S0K-TSN19817S0K; TSN20171S0K-TSN20264S0K; TSN20252S0K-TSN20264S0K; TSN20118S0K-TSN20170S0K; TSN20088S0K-TSN20117S0K; TSN20051S0K-TSN20087S0K; TSN19993S0K-TSN20050S0K; TSN19900S0K-TSN19908S0K; TSN19197S0K-TSN19222S0K; TSN20186S0K-TSN20216S0K; TSN19886S0K-TSN19895S0K; TSN20336S0K-TSN20346S0K; TSN18819S0K-TSN18835S0K; TSN18836S0K-TSN18903S0K; TSN19672S0K-TSN19682S0K; TSN18929S0K-TSN18918S0K; TSN18930S0K-TSN18943S0K; TSN18791S0K-TSN18801S0K; TSN07386S0K-TSN07401S0K; TSN19128S0K-TSN19151S0K; TSN19709S0K-TSN19776S0K; TSN19726S0K-TSN19776S0K; TSN18716S0K-TSN18735S0K; TSN19777S0K-TSN19783S0K; TSN19152S0K-TSN19189S0K; TSN18687S0K-TSN18715S0K; TSN18554S0K-TSN18589S0K; TSN18944S0K-TSN18956S0K; TSN18661S0K-TSN18686S0K; TSN18667SOK-TSN18686SOK; TSN18977S0K-TSN19005S0K; TSN19479S0K-TSN19495S0K; TSN19591S0K-TSN19623S0K; TSN59962SOK-TSN59985SOK; TSN61804SOK-TSN61822SOK; TSN60176SOK-TSN60192SOK; TSN62084SOK-TSN62090SOK; TSN60502SOK-0TSN61603SOK; TSN60679SOK-TSN60711SOK;

with environmental media (soils, surface water, ground water, stream and lake sediments). As a consequence, these constituents are found as contaminants in soils, edge of field run off, surface waters in streams and in Lake Tenkiller, ground water, stream sediments and lake sediments.[5] Since these constituents would not be present as contaminants in soils, edge of field run off, surface waters in streams and in Lake Tenkiller, ground water, stream sediments and lake sediments except for the actions and practices of Defendants, the Defendants' actions and practices have resulted in the pollution of surface water, ground water, soil and sediment within the Illinois River Watershed.

2. Defendants have a long and substantial history of poultry production within the Illinois River Watershed. Northwest Arkansas, particularly Washington and Benton counties, presently produces and has historically produced the majority of poultry in Arkansas.[6] Poultry production in this region was known as early as around the turn of the century, but transitioned from a supplemental income business to a highly organized industry beginning in the 1920s.[7] In 1927, a severe drought devastated northwest

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TSN115069SOK-TSN115091SOK; TSN115092SOK-TSN115112SOK; TSN115113SOK-TSN1151132OK; TSN61878SOK-TSN61899SOK; TSN61528SOK-TSN61537SOK; TSN60756SOK-TSN60770SOK; TSN47940SOK-TSN47956SOK; TSN60030SOK-TSN60046SOK; TSN59901SOK-TSN59916SOK; TSN60503SOK-TSN60507SOK; TSN72021SOK-TSN72032SOK; PFIRWP-01058-PFIRWP-01097; PFIRWP-000185-PFIRWP-000195; PFIRWP-000703-PFIRWP-001427; PFIRWP-000317-PFIRWP-000330; PFIRWP-000383-PFIRWP-000383; PFIRWP-000333-PFIRWP-000346; PFIRWP-060344-PFIRWP-060377; PFIRWP-000690-PFIRWP-000702; PFIRWP-000459-PFIRWP-000461; PFIRWP-000489-PFIRWP-000515; PFIRWP-000565-PFIRWP-000589; PFIRWP-000108-PFIRWP-000113; PFIRWP-024980-PFIRWP-024983; GE4030-GE4046; GE7055-GE7076; GE34065-GE34081; GE34209-GE34245; GE2357-GE2351; GE34003-GE34013; GE34147-GE34163; Cal-Maine East Farm; Cal-Maine West-East appl Sites; Cal-Maine West-East Farms IRW; Dick Latta SunBest Farm; Dick Latta SunBest Farm appl sites 2; CM-000003160-CM-000003204; CM-000002945-CM000003132.

5 Expert Report of Roger L. Olsen, 2008; Expert Report of Bernie Engle, 2008; Expert Report of Gordon V. Johnson, 2008; Expert Report of G. Dennis Cooke and Eugene Welch, 2008; Expert Report of Valerie Harwood; Expert Report of Jan Stevenson.

6 Poultry in the Arkansas Encyclopedia of History and Culture, http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=2102; Strausberg, S. F. 1995. From Hills and Hollers: Rise of the Poultry Industry in Arkansas. Fayetteville: Arkansas Agricultural Experiment Station.

7 Poultry in the Arkansas Encyclopedia of History and Culture, http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=2102; Strausberg, S. F. 1995. From Hills and Hollers: Rise of the Poultry Industry in Arkansas. Fayetteville: Arkansas Agricultural Experiment Station.

the order of 30 m displacements.[107] Joints are common and appear to be controlled by uplift that resulted in extensional fractures. The faults and fractures that control drainage within the Illinois River Watershed are primarily associated with the Ozark uplift. The Ozark uplift postdates the deposition of the youngest bedrock (Mississippian) within the Illinois River Watershed.[108] As a result, this uplift disturbed all strata within the Illinois River Watershed. Consequently, significant fracturing and faulting observed at the surface within the Illinois River Watershed penetrates deeply into all of the geologic formations within the Illinois River Watershed. This deep fracturing is significant, because its presence means that the constituents from land application of poultry waste can not only easily move into shallow aquifers along dissolution-expanded (karsted) infiltration routes, it can also penetrate to greater depths along the deep seated fractures and faults, and thus threaten deeper aquifers. A map showing major faults fractures and significant linemaments is given in Fig 12.

The terrain of the bulk of the Illinois River Watershed is mantled karst.[109] In mantled karst terrains the dissolution of carbonate units beneath a covering of soil and regolith creates expanded infiltration pathways including, sinkholes, solution expanded fractures, faults and caves. The fracturing and faulting within the Illinois River Watershed, combined with karstification (which enlarges subsurface faults and fractures) produces areas of high

107 Stanton, G.P., and Brahana, J.V., 1996, Structural control on hydrogeology of a mantled karst aquifer in northwestern Arkansas: Geological Society of America Abstracts with Programs, v. 28, no. 7, p. 334.

108 Hudson, M. R. 2000. Coordinated strike-slip and normal faulting in the southern Ozark dome of northern Arkansas: Deformation in a late Paleozoic foreland. Geology, 28:511-514 (PI-Fisher00001752- PI-Fisher00001755); Imes, J. L. and L. F. Emmett. 1994. Geohydrology of the Ozark Plateaus Aquifer System in Parts of Missiouri, Arkansas, Oklahoma and Kansas. USGS Professional Paper 1414-D (PI-Fisher00002912. - PI-Fisher00003051).

109 Stanton, G.P., and Brahana, J.V., 1996, Structural control on hydrogeology of a mantled karst aquifer in northwestern Arkansas: Geological Society of America Abstracts with Programs, v. 28, no. 7, p. 334; Adamski, J. C., J. C. Peterson, D. A. Freiwald and J. V. Davis. 1994. Environmental and hydrologic setting of the Ozark Plateaus Study Unit, Arkansas, Kansas, Missouri, and Oklahoma, USGS WRI 94-4022 ((PI-Fisher00002644 - PI-Fisher00002719) ; Salisbury, D. O. and Davis, R. K. 1997. A hydrogeological and hydrochemical connection between the Decatur City Spring and Crystal Lake, Benton County, Arkansas. J. Arkansas Academy of Science, 51: 159 – 168 (PI-Fisher00000092- PI-Fisher00000101).

permeability, and results in a circumstance in which shallow ground water aquifers are particularly susceptible to impact by surface contamination, including contamination by bacteria, that can readily travel from the soil surface to surface water and ground water during rainfall events. A diagram illustrating the relationship between fractures and solution activity in carbonate rocks is provided in Fig 13. Within such a karst terrain, there is little attenuation (reduction) of contaminants as they move from the land surface into and through the karst aquifer. Thus, land application of poultry waste to the karst terrain of the Illinois River Watershed means that constituents of this waste (including bacteria) travel readily through the soils and underlying geologic media to discharge at and into ground water springs and surface streams throughout the Illinois River Watershed. Further, because of the ready flow of water through a karst terrain of the type present in the Illinois River Watershed, there is strong interaction between surface water flow and ground water flow so that surface waters readily become ground water and ground water readily becomes surface water. The phenomenon is readily shown by the numerous springs and gaining and losing streams found within the Illinois River Watershed.

Soils within the Illinois River Watershed are formed mostly from the weathering of carbonate rocks, and are of low natural fertility.[110] The soils are typically loams and are often rocky due to the presence of chert fragments. Loam soils are mixtures of sand, silt, clay and organic matter. Depending on the relative proportion of sand, silt and clay, these

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110 Osborn, N. L. 2001. Minor Basin Hydrogeologic Investigation Report of the Boone Groundwater Basin, Northeastern Oklahoma. Oklahoma Water Resources Board Technical Report GW2001-2. (PI-Fisher00003605 - PI-Fisher00003630); United States Department of Agriculture Soil Conservation Service and Forest Service In cooperation with Arkansas Agricultural Experiment Station. 1977. Soil Survey of Benton County, Arkansas; United States Department of Agriculture Soil Conservation Service and Forest Service In cooperation with Arkansas Agricultural Experiment Station. 1969. Soil Survey of Washington County, Arkansas; U.S. Dept. of Agriculture, Soil Conservation Service. 1965. Soil survey, Adair County, Oklahoma; U.S. Dept. of Agriculture, Soil Conservation Service. 1970. Soil survey, Cherokee and Delaware Counties, Oklahoma; United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Oklahoma Agricultural Experiment Station and the Oklahoma Conservation Commission. Supplement to the Soil Survey of Adair County, Oklahoma; United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Oklahoma Agricultural Experiment Station and the Oklahoma Conservation Commission. Supplement to the Soil Survey of Delaware County, Oklahoma.

soils will be susceptible to infiltration or surface runoff.[111] As shown in Fig 14, soils more susceptible to run off dominate in the eastern and western portions of the Illinois River Watershed, while soils that are more susceptible to infiltration dominate in the central portion of the Illinois River Watershed.[112] Thus, contaminants deposited on the surface within the Illinois River Watershed are prone to runoff from soils in about half of the watershed and are prone to infiltration through soils in the remaining half of the watershed.

The features discussed above are schematically shown in Fig 15 which provides a site conceptual model for the Illinois River Watershed. The fractured and karsted bedrock is shown in brown in the cross section.

20. Shallow ground water within the Illinois River Watershed is highly susceptible to contamination from surface-applied pollutants. The shallow bedrock aquifer within the

111 Al-Qinna, M. I. 2003. Measuring and modeling soil water and solute transport with emphasis on physical mechanisms in karst topography. M.S. Thesis, University of Arkansas. . (PI-Fisher00003977- PI-Fisher00004270); Davis, R. K., J. V. Brahana, J. S. Johnson. 2000. Ground water in northwest Arkansas: Minimizing nutrient contamination from non-point sources in karst terrane. Arkansas Soil and Water Conservation Commission, Publication No. MSC-288 (PI-Fisher00003116 - PI-Fisher00003288); United States Department of Agriculture Soil Conservation Service and Forest Service In cooperation with Arkansas Agricultural Experiment Station. 1977. Soil Survey of Benton County, Arkansas; United States Department of Agriculture Soil Conservation Service and Forest Service In cooperation with Arkansas Agricultural Experiment Station. 1969. Soil Survey of Washington County, Arkansas; U.S. Dept. of Agriculture, Soil Conservation Service. 1965. Soil survey, Adair County, Oklahoma; U.S. Dept. of Agriculture, Soil Conservation Service. 1970. Soil survey, Cherokee and Delaware Counties, Oklahoma; United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Oklahoma Agricultural Experiment Station and the Oklahoma Conservation Commission. Supplement to the Soil Survey of Adair County, Oklahoma; United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Oklahoma Agricultural Experiment Station and the Oklahoma Conservation Commission. Supplement to the Soil Survey of Delaware County, Oklahoma.

112 The eastern portion of the Illinois River Watershed comprises upland soils belonging to hydrologic class "C", and to a lesser areal extent, soils within valley alluvium belonging to hydrologic class "B". The central portion of the Illinois River Watershed is dominated by soils belonging to hydrologic class "B", while the western portion of the Illinois River Watershed comprises soils belonging to hydrologic class "D". The least transmissive layer of soils belonging to hydrologic class "B" have a saturated hydraulic conductivity of between 1.42 – 5.67 in/hour (10-40 mm/s), and thus have much a greater infiltration potential (and, consequently, a much lower runoff potential) than soils in hydrologic class "C" in which the least transmissive layer has a saturated hydraulic conductivity of between 0.14 - 1.42 in/hour (1-10 mm/s) or soils in hydrologic class "D in which the least transmissive layer has a saturated hydraulic conductivity of < 0.14 in/hour (< 1 mm/s). See USDA NRCS 2007. National Engineering Handbook,

Signature

I reserve the right to supplement, modify and amend this opinion based on discovery of any new facts or data, reinterpretation of any existing or new facts or data, or to rebut opinions or evidence provided by other experts in this matter.

J. Berton Fisher, Ph.D.